Table 10.2B: Enforceable Snohomish County Document Updates Beyond Ecology's List of Significant Changes (Snohomish County Drainage Manual)

Notes:

1. In addition to the changes listed in this table, there are various typographical corrections and non-substantive minor editorial changes to the Snohomish County Drainage Manual. All changes are shown in the strikeout – underline versions of the Drainage Manual volumes.
2. Page numbers in this table refer to the strikeout/underline versions of the documents

Line #	Brief Description of the Change	Rationale for the Change (attach supporting documents if necessary)	Enforceable Document Being Updated	Section Within the Enforceable Document Being Updated	Text as Written in the 2014 Functionally Equivalent Enforceable Document	Proposed Text for Ecology Review and Approval
1.	Deletion of non-substantive explanatory paragraph	Text not needed so it was deleted	Drainage Manual Volume I	Chapter 1.1.1, Background, page 1	The primary difference between this Drainage Manual and the previous version is an expansion of requirements related to low impact development (LID), mostly focusing on requirements for on-site stormwater management (see Volume I, Minimum Requirement 5). Other important changes include a revised hydrologic model (WWHM12), a fundamentally different way to account for stormwater impacts to wetlands (see Volume I, Appendix I-D), and revisions to design requirements for a number of stormwater best management practices (BMPs) including bioretention, rain gardens, and stormwater infiltration systems.	[text deleted]
2.	Change to explanatory paragraph	Clarification	Drainage Manual Volume I	1.1.2 Stormwater and Low Impact Development, page 1	The goal of LID is to prevent measurable physical, chemical or biological degradation to streams, lakes, wetlands, and other natural aquatic systems from commercial, residential or industrial development sites.	The goal of LID is to prevent measurable physical, chemical or biological degradation to streams, lakes, wetlands, and other natural aquatic systems from occurring as a result of development activity on commercial, residential or industrial sites.
3.	Addition of text describing addition of Volume VI.	N/A	Drainage Manual Volume I	1.2 Organization of the Snohomish County Drainage Manual, page 3	Volume V contains BMPs to treat runoff that contains sediment or other pollutants from developed sites. These BMPs are typically referred to as treatment BMPs.	Volume V contains BMPs to treat runoff that contains sediment or other pollutants from developed sites. These BMPs are typically referred to as treatment BMPs. Volume V also contains maintenance requirements applicable to all flow control and treatment BMPs. Volume VI contains specific maintenance standards for the stormwater flow control and treatment BMPs presented in Volumes III and V.
4.	Text change to match text of thresholds for new development	Consistency between text and figure	Drainage Manual Volume I	Figure 1.1 Minimum Requirements (MR's) for New Development Projects	Does the existing site have 35% or more existing impervious surface **OR** does the project otherwise meet the definition of redevelopment in Chapter 30.91R SCC?	Does the site have 35% or more existing hard surface **OR** does the project otherwise meet the definition of redevelopment in Chapter 30.91R SCC?
5.	Deletion of reference to WWHM	Phrase is superfluous from the perspective of directing a designer.	Drainage Manual Volume I	2.5.7 Minimum Requirement 7: Flow Control, page 26,	The pre-developed condition shall be matched to the fully-forested condition (soils and vegetation) to which the Western Washington Hydrologic Model (WWHM) is calibrated, unless…	The pre-developed condition shall be matched to the fully-forested condition (soils and vegetation) unless…
6.	Deletion of text related to detention in parking lots	Information is presented in Volume III, Chapter 3.2.5 Other Detention Options	Drainage Manual Volume I	2.5.7 Minimum Requirement 7: Flow Control, page 27	The volume of stormwater ponded in a parking lot may be considered as part of the required storage volume for flow control if all of the following requirements are met: • ponding is limited to a 0.5 foot elevation at the curb line;	[text deleted]

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					• no ponding is allowed in the emergency or drive lanes during a 100-year storm event; • discharges from the project site must meet the flow control standard applicable to the project in accordance with Volume III, Chapter 3 of this manual; and • the proposal complies with all other applicable code requirements and regulations.	
7.	Defined new term: "Approved continuous runoff hydrologic model"	Definition created to work in concert with revisions to the models approved for use	Drainage Manual Volume I	Appendix I, page 91	[no definition]	**Approved continuous runoff hydrologic Model:** The continuous runoff hydrologic models identified in Volume III, Chapter 2.1.
8.	Defined new term: "Fully stabilized"	Definition created to clarify	Drainage Manual Volume I	Appendix I, page 113	[no definition]	**Fully stabilized** The establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as riprap, gabions or geotextiles) which prevents erosion.
9.	Revised definition of "land disturbing activity"	Revised definition to match code (see Table 10-2 for code revisions)	Drainage Manual Volume I	Appendix 1, page 123	**Land disturbing activity** Any activity that will result in movement of earth or a change in the existing soil cover or the existing soil topography (both vegetative and non-vegetative), including the creation and/or replacement of impervious surfaces. Land disturbing activities include, but are not limited to, clearing, filling, excavation, and grading. Land disturbing activities do not include agricultural plowing and tilling exempt from stormwater regulations pursuant to SCC 30.63A.200. Compaction that is associated with stabilization of structures and road construction also is a land disturbing activity. Vegetation and drainage facility maintenance practices are not land disturbing activities, provided that the maintenance is performed according to standards adopted by Snohomish County.	**Land disturbing activity** Any activity that will result in movement of earth or a change in the existing soil cover or the existing soil topography (both vegetative and non-vegetative), including the creation and/or replacement of impervious surfaces. Land disturbing activities include, but are not limited to, clearing, filling, excavation, and grading. Land disturbing activities do not include agricultural plowing and tilling exempt from stormwater regulations pursuant to SCC 30.63A.200. Compaction that is associated with stabilization of structures and road construction also is a land disturbing activity. Vegetation management practices, including landscape maintenance and gardening, are not land disturbing activities. Drainage facility maintenance practices are not land disturbing activities, provided that the maintenance is performed according to standards adopted by Snohomish County.
10.	Modify definition of "maintenance'	Revised definition to match code (see Table 10-2 for code revisions)	Drainage Manual Volume I	Appendix 1, page 125	**Maintenance** Activities conducted on currently serviceable structures, facilities and equipment that involve no expansion or use beyond that previously existing and result in no significant adverse hydrologic impact. It includes those usual activities taken to prevent a decline, lapse or cessation in the use of structures and systems. Those usual activities may include replacement of dysfunctional facilities, including cases where any permit requires replacing an existing structure with a different type structure, as long as the functioning characteristics of the original structure are	**Maintenance** See SCC 30.91M.011. Activities conducted on currently serviceable structures, facilities and equipment that involve no expansion or use beyond that previously existing and result in no significant adverse hydrologic impact. It includes those usual activities taken to prevent a decline, lapse or cessation in the use of structures and systems. Those usual activities may include replacement of dysfunctional facilities, including cases where any permit requires replacing an existing structure with a different type structure, as long as the functioning characteristics of the original structure are not changed.

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					not changed. Maintenance does not include expansion in physical dimension, capacity or use.	
11.	Revise definition of "runoff"	Replace existing definition 30.91R.252 with Ecology definition.	Drainage Manual Volume I	Appendix I page 139	**Runoff.** See SCC 30.91R.252. Water originating from rainfall and other precipitation that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes and wetlands as well as shallow groundwater. It includes the portion of rainfall or other precipitation that becomes surface flow and interflow.	Runoff See SCC 30.91R.252. Water that travels across the land surface and discharges to water bodies either directly or through a collection and conveyance system. See also "Stormwater."
12.	Revise definition of "stormwater runoff"	Replace existing definition 30.91S.600 with Ecology definition.	Drainage Manual Volume I	Appendix I, page 143	**Stormwater** That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes and other features of a stormwater drainage system into a defined surface waterbody, or a constructed infiltration facility.	**Stormwater** See SCC 30.91S.600. Runoff during and following precipitation and snowmelt events, including surface runoff, drainage, and interflow.
13.	Replace existing definition of "threshold discharge area (TDA)".	Replace existing definition 30.91T.054B with Ecology definition.	Drainage Manual Volume I	Appendix I, page 147	**Threshold discharge area** An onsite area draining to a single natural discharge location or multiple natural discharge locations that combine within one-quarter mile downstream as determined by the shortest flowpath. See figure below	**Threshold discharge area** See 30.91T.054B. An area within a project site draining to a single natural discharge location or multiple natural discharge locations that combine within one-quarter mile downstream (as determined by the shortest flowpath). See the following figure for examples.
14.	Revise website link	Revision matches Ecology Manual	Drainage Manual Volume II	Various pages	The Washington State Department of Ecology has approved products as able to meet the requirements of this BMP. Snohomish County may approve these products if they are used in accordance with all requirements of this BMP and all instructions and specifications provided by the manufacturer, plus additional requirements that may be established by the County. These products are available for review at http://www.ecy.wa.gov/programs/wq/stormwater/newtech/equivalent.html.	The Washington State Department of Ecology has approved products as able to meet the requirements of this BMP. Snohomish County may approve these products if they are used in accordance with all requirements of this BMP and all instructions and specifications provided by the manufacturer, plus additional requirements that may be established by the County. These products are available for review at https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies
15.	Revise website link	Revision matches Ecology Manual	Drainage Manual Volume II	Chapter 4, BMP C.160 Certified Erosion and Sediment Control Lead, page 75	Have a current certificate proving attendance in an erosion and sediment control training course that meets the minimum ESC training and certification requirements established by Ecology (Ecology will maintain a list of ESC training and certification providers at: http://www.ecy.wa.gov/programs/wq/stormwater/cescl.html).	Have a current certificate proving attendance in an erosion and sediment control training course that meets the minimum ESC training and certification requirements established by Ecology. (Ecology will maintain a list of ESC training and certification providers at: https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Certified-erosion-sediment-control.)

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16.	Rename BMP C202 to match name in 2019 Ecology Stormwater Manual	Needed to support Required Significant Change 4. Minimum Requirement 2	Drainage Manual Volume II	Chapter 4, BMP C.202, page 88, and as referenced throughout the Drainage Manual	BMP C202 – Channel Lining	BMP C202 – Riprap Channel Lining
17.	Rename BMP C208 to match name in 2019 Ecology Stormwater Manual	Needed to support Required Significant Change 4. Minimum Requirement 2	Drainage Manual Volume II	Chapter 4, BMP C.208, page 104, and as referenced throughout the Drainage Manual	BMP C208 – Triangular Silt Dike (Geotextile Encased Check Dam)	BMP C208 – Triangular Silt Dike (TSD)
18.	Rename BMP C241 to match name in 2019 Ecology Stormwater Manual	Needed to support Required Significant Change 4. Minimum Requirement 2	Drainage Manual Volume II	Chapter 4, BMP C.241, page 133, and as referenced throughout the Drainage Manual	BMP C241 – Temporary Sediment Pond	BMP C241 – Sediment Pond (Temporary)
19.	Delete BMP C253	Ecology deleted this BMP from the 2019 SWMMWW	Drainage Manual Volume II	Chapter 4, BMP C.253, page 147, and as referenced throughout the Drainage Manual	[entire text of BMP C253]	[deleted]
20.	Revised text of Volume III Chapter 1.1	Adds clarity and matches other revised content	Drainage Manual Volume III	Chapter 1.1, page 1	This volume of the Snohomish County Drainage Manual provides best management practices (BMPs) for providing stormwater flow control for new development and redevelopment, as required by SCC 30.63A.550. This volume presents techniques of hydrologic analysis, and BMPs related to management of the amount and timing of stormwater flows from developed sites. BMPs for preventing pollution of stormwater runoff and for treating contaminated runoff are presented in Volumes IV and V, respectively.	This volume of the Snohomish County Drainage Manual sets forth specific requirements and information for providing stormwater flow control for new development and redevelopment, as required by SCC 30.63A.550. This volume provides requirements and techniques for hydrologic modeling of runoff treatment and flow control BMPs, basin planning, and closed depressions. It also sets forth design and construction criteria for flow control BMPs including detention, infiltration, bioretention, and permeable pavement. BMPs for preventing pollution of stormwater runoff and for treating contaminated runoff are presented in Volumes IV and V, respectively.
21.	Revised text of Volume III Chapter 1.2	Adds clarity and matches other revised content	Drainage Manual Volume III	Chapter 1.2, page 1	Volume III of the stormwater manual contains three chapters. Chapter 1 serves as an introduction. Chapter 2 reviews methods of hydrologic analysis, covers the use of hydrograph methods for designing BMPs, and provides an overview of various computerized modeling methods and analysis of closed depressions. Chapter 3 describes flow control BMPs and provides design specifications for roof downspout runoff controls, detention facilities, and infiltration facilities, and selected design information for bioretention and permeable pavement.	Volume III of the drainage manual contains three chapters. Chapter 1 serves as an introduction. Chapter 2 covers required hydrologic methods for runoff treatment and flow control BMPs, basin planning, and closed depression analysis. Chapter 3 describes flow control BMPs and provides design specifications for roof downspout runoff controls, detention facilities, and infiltration facilities, and selected design information for bioretention and permeable pavement.

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					This volume includes three appendices. Appendix A has isopluvial maps for western Washington. Appendix B has information and assumptions on the Western Washington Hydrology Model (WWHM). Appendix C includes detailed information concerning how to represent various Low Impact Development (LID) techniques in continuous runoff models so that the models predict lower surface runoff rates and volumes.	
22.	Revised text of Volume III Chapter 1.3	Adds clarity and matches other revised content	Drainage Manual Volume III	Chapter 1.3, pages 1-2	SCC 30.63A.300 through SCC 30.63A.310 and Volume I of this manual should be consulted to determine the applicable requirements for flow control. After these requirements have been determined, this volume should be consulted for the design and construction of flow control facilities. These facilities can then be included in Stormwater Site Plans as required by SCC 30.63A.400.	SCC 30.63A.300 through SCC 30.63A.310 and Volume I of this manual should be consulted to determine the applicable requirements for runoff treatment and flow control. After these requirements have been determined, this volume should be consulted for determining hydrologic analysis requirements for runoff treatment and flow control BMPs. This volume should be referenced for the design and construction of flow control BMPs, including analysis of infiltration BMPs. Volume V, in conjunction with this volume, may need to be referenced for the purpose of designing runoff treatment BMPs. Runoff treatment and flow control BMPs can then be included in Stormwater Site Plans as required by SCC 30.63A.400.
23.	Revised text in Chapter 2.3.1, Water Quality Design Storm	Revised for clarity, no change to substance	Drainage Manual Volume III	Chapter 2.3.1, Water Quality Design Storm, page 14	The design storm for sizing wetpool treatment facilities is the 6-month, 24-hour storm. Unless amended to reflect local precipitation statistics, the 6-month, 24-hour precipitation amount may be assumed to be 72 percent of the 2-year, 24-hour amount. Precipitation estimates of the 6-month and 2-year, 24-hour storms for certain towns and cities are listed in Appendix 1-B of Volume I. For other areas, interpolating between isopluvials for the 2-year, 24-hour precipitation and multiplying by 72% yields the appropriate storm size. The total depth of rainfall (in tenths of an inch) for storms of 24-hour duration and 2, 5, 10, 25, 50, and 100-year recurrence intervals are published by the National Oceanic and Atmospheric Administration (NOAA). The information is presented in the form of "isopluvial" maps for each state. Isopluvial maps are maps where the contours represent total inches of rainfall for a specific duration. Isopluvial maps for the 2, 5, 10, 25, 50, and 100-year recurrence interval and 24-hour duration storm events can be found in the NOAA Atlas 2, "Precipitation - Frequency Atlas of the Western United States, Volume IX-Washington." Appendix II-A provides the isopluvials for the 2, 10, and 100-year, 24-hour design	Appendix III-A provides an isopluvial map for the 2-year, 24-hour rainfall depth at locations in Western Washington. The design storm for sizing wetpool treatment facilities is the 6-month, 24-hour rainfall depth, which shall be calculated as 72% of the 2-year, 24-hour rainfall depth at the project location. For projects locations that do not lie on an isopluvial contour, interpolate between isopluvial contours for the 2-year, 24-hour rainfall depth and multiply by 72% to determine the design storm depth.

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					storms. Other precipitation frequency data may be obtained through Western Regional Climate Center (WRCC) at Tel: (775) 674-7010.	
24.	Revisions to Table 3.2 - Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Areas	Revisions match 2019 information in Ecology SWMMWW	Drainage Manual Volume III	Table 3.2, page 19	**Permeable Pavement (See Appendix C to decide which condition below to use)** Landscaped area 77 85 90 92 50% landscaped area/50% impervious 87 91 94 96 100% impervious area 98 98 98 98	**Permeable Pavement** Porous Asphalt, Pervious Concrete, or Grid/Lattice Systems (without underdrains) 77 85 90 92 Paving Blocks (without underdrains) 87 91 94 96 All Permeable Pavement Types (with underdrains) 98 98 98 98
25.	Revision to 3.1 Roof Downspout Controls	Deleted general information; specific information presented elsewhere	Drainage Manual Volume III	Chapter 3.1 – Roof Downspout Controls, page 22	This section presents the criteria for design and implementation of roof downspout controls in accordance with the on-site stormwater management requirements of Minimum Requirement 5 as set forth in SCC 30.63A.525 and Volume I, Chapter 2.5.5 of this manual. Ecology's Western Washington Hydrology Model (WWHM) incorporates flow credits for BMP T5.10A – Downspout Full Infiltration Systems, and BMP T5.10B – Downspout Dispersion Systems.	This section presents the criteria for design and implementation of roof downspout controls in accordance with the on-site stormwater management requirements of Minimum Requirement 5 as set forth in SCC 30.63A.525 and Volume I, Chapter 2.5.5 of this manual.
26.	Revisions hydrologic modeling text in 3.1.2 Downspout Dispersion Systems (BMP T5.10B)	Update information to match 2019 Ecology SWMMWW modeling content	Drainage Manual Volume III	Chapter 3.1.2, Downspout Dispersion Systems, page 28	**Hydrologic Modeling Credits for Roof Runoff Dispersion Systems** For single-family residential lots greater than 22,000 square feet, if roof runoff is dispersed according to the requirements of this section and the vegetative flow path is 50 feet or larger through undisturbed native landscape or lawn/landscape area that meets BMP T5.13, the NPGIS area may be modeled as grassed surface. If the available vegetated flowpath is 25 to 50 feet, use of a dispersion trench allows modeling the roof as 50% impervious/50% landscape. This is done in the WWHM on the Mitigated Scenarios screen by entering the NPGIS area into one of the entry options for dispersal of impervious area runoff.	**Runoff model representation** If roof runoff is dispersed according to the requirements of this section the roof area should be modeled as a lateral flow impervious basin connected to a lawn/landscape lateral flow basin which represents the area used for dispersion. Alternatively, where multiple downspout dispersions will occur the following methods may be used. • If the vegetative flow path is 50 feet or larger through undisturbed native landscape or lawn/landscape area that meets BMP T5.13, the NPGIS area may be modeled as grassed surface. • If the available vegetated flowpath is 25 to 50 feet, use of a dispersion trench allows modeling the roof as 50% impervious/50% grass. For the purpose of tracking impervious area modeled as pervious area, WWHM2012 provides LID pervious land segment entries to represent the impervious area being modeled as grass.

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27.	Revise Chapter 3.2 - Detention Facilities last paragraph	Correct statement about dam safety standards	Drainage Manual Volume III	Chapter 3.2 - Detention Facilities, page 37	Stormwater detention facilities that can impound 10 acre-feet (435,600 cubic feet; 3.26 million gallons) or more with the water level measured at the embankment crest are subject to the state's dam safety requirements, set forth in Chapter 173-175 Washington Administrative Code. Technical design requirements and procedural requirements for plan review and approval described in detail in guidance documents developed by and available from the Washington State Department of Ecology Dam Safety Office at http://www.ecy.wa.gov/programs/wr/dams/dss.html.	Stormwater detention facilities that can impound 10 acre-feet (435,600 cubic feet; 3.26 million gallons) or more with the water level measured at the embankment crest may be subject to the state's dam safety requirements, set forth in Chapter 173-175 Washington Administrative Code. Technical design requirements and procedural requirements for plan review and approval described in detail in guidance documents developed by and available from the Washington State Department of Ecology Dam Safety Office at https://ecology.wa.gov/Water-Shorelines/Water-supply/Dams.
28.	Added section on outfall systems to Chapter 3.2.1 Detention Ponds	Existing Chapter 3.2.1 did not have a section on outfall systems but they are required element to consider.	Drainage Manual Volume III	Chapter 3.2.1, page 39	[no text]	**Outfall systems** Properly designed outfalls are critical to reducing the chance of adverse impacts as the result of concentrated discharges from pipe systems and culverts, both onsite and downstream. Outfall systems include rock splash pads, flow dispersal trenches, gabion or other energy dissipaters, and tightline systems. A tightline system is typically a continuous length of pipe used to convey flows down a steep or sensitive slope with appropriate energy dissipation at the discharge end. Detailed requirements for outfall systems are found in Volume V, Chapter 4.5.3.
29.	Revised text related to emergency overflow spillway design	Revision .	Drainage Manual Volume III	Chapter 3.2.1, page 41	Q_{100} is either the peak volumetric flow rate calculated using a 10-minute time step from the 100-year, 24-hour storm and a Type 1A distribution, or the 100-year, 1-hour flow, indicated by an approved continuous runoff model, multiplied by a factor of 1.6.	Q_{100} is either the peak volumetric flow rate calculated using a 10-minute time step from the 100-year, 24-hour storm and a Type 1A distribution, or the 100-year flow rate, indicated by an approved continuous runoff hydrologic model.
30.	Revised text to Chapter 3.3.4, Simplified Design (for infiltration systems)	Replace text with defined term "water quality design volume."	Drainage Manual Volume III	Chapter 3.3.4, page 56	Ensure that the maximum pond depth stays below the minimum required freeboard. For infiltration facilities intended to meet the stormwater treatment requirements of Minimum Requirement 6, use the output files from the hydrologic model used for design to document that the facility can infiltrate 91 percent of the influent runoff file and that the 91st percentile, 24-hour runoff volume can infiltrate through the infiltration basin surface within 48 hours. The latter can be calculated by multiplying a horizontal projection of the infiltration basin mid-depth dimensions by the estimated long-term infiltration rate; and multiplying the result by 48 hours.	Ensure that the maximum pond depth stays below the minimum required freeboard. For infiltration facilities intended to meet the stormwater treatment requirements of Minimum Requirement 6, use the output files from the hydrologic model used for design to document that the facility can infiltrate 91% of the influent runoff file and that the water quality design volume can infiltrate through the infiltration basin surface within 48 hours. The latter can be calculated by multiplying a horizontal projection of the infiltration basin mid-depth dimensions by the estimated long-term infiltration rate; and multiplying the result by 48 hours.
31.	Revised text in Chapter 3.3.9 - Calculating the Size of Infiltration Facilities	Updated text is in accord with 2019 Ecology SWMMWW modeling requirements	Drainage Manual Volume III	3.3.9 Calculating the Size of Infiltration Facilities, page 69	In order to determine compliance with the flow control requirements, the Western Washington Hydrology Model (WWHM), or an appropriately calibrated continuous simulation model based on HSPF, must be used. When using WWHM for simulating flow through an infiltrating facility, represent the	In order to determine compliance with the flow control requirements an approved continuous runoff hydrologic model must be used. When using WWHM2012 for simulating flow through an infiltrating facility, represent the facility by using a Pond Element and entering the pre-determined infiltration rates.

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					facility by using a Pond Element and entering the pre-determined infiltration rates. Below are the procedures for sizing an infiltration facility (A) to completely infiltrate 100% of runoff; (B) to treat 91% of runoff to meet the water quality treatment requirements, and (C) to partially infiltrate runoff in conjunction with a detention facility that provides flow control for the overflow from the infiltration facility.	Below are the procedures for sizing an infiltration facility (A) to completely infiltrate 100% of runoff; (B) to treat 91% of runoff to meet the water quality treatment requirements, and (C) to partially infiltrate runoff in conjunction with a detention facility that provides flow control for the overflow from the infiltration facility.
32.	Revised text in Chapter 3.3.9 - Calculating the Size of Infiltration Facilities	Updated text is in accord with 2019 Ecology SWMMWW modeling requirements	Drainage Manual Volume III	3.3.9 Calculating the Size of Infiltration Facilities, page 70	An ***off-line*** infiltration treatment facility placed ***upstream*** of a detention facility must have a flow splitter designed to send all flows at or below the 15-minute water quality flow rate, as predicted by WWHM (or other approved continuous runoff model), to the infiltration facility. Within the WWHM, the flow splitter icon is placed ahead of the pond element which represents the infiltration facility. The infiltration facility must be sized to infiltrate all the runoff sent to it (no overflows from the infiltration facility are allowed). An ***off-line*** infiltration treatment facility placed ***downstream*** of a detention facility must have a flow splitter designed to send all flows at or below the 2-year flow frequency from the detention pond, as predicted by WWHM (or other approved continuous runoff model), to the infiltration facility. Within the WWHM, the flow splitter icon is placed ahead of the pond element which represents the infiltration facility. The infiltration facility must be sized to infiltrate all the runoff sent to it (no overflows from the infiltration facility are allowed).	An ***off-line*** infiltration treatment facility placed ***upstream*** of a detention facility must have a flow splitter designed to send all flows at or below the water quality flow rate, as predicted by an approved continuous runoff hydrologic model, to the infiltration facility. Within WWHM2012, the flow splitter icon is placed ahead of the pond element which represents the infiltration facility. The infiltration facility must be sized to infiltrate all the runoff sent to it (no overflows from the infiltration facility are allowed). An ***off-line*** infiltration treatment facility placed ***downstream*** of a detention facility must have a flow splitter designed to send all flows at or below the 2-year flow frequency from the detention pond, as predicted by an approved continuous runoff hydrologic model, to the infiltration facility. Within WWHM2012, the flow splitter icon is placed ahead of the pond element which represents the infiltration facility. The infiltration facility must be sized to infiltrate all the runoff sent to it (no overflows from the infiltration facility are allowed).
33.	Deletion of Appendix III-B – Western Washington Hydrologic Model: Information, Assumptions, and Computational Steps	All relevant information is presented elsewhere in the Drainage Manual.	Drainage Manual Volume III	Appendix III-B Pages 89-101	[see deleted text]	[no text]
34.	Deletion of Appendix III-C – Washington State Department of Ecology Low Impact Development Flow Modeling Guidance	All relevant information is presented elsewhere in the Drainage Manual.	Drainage Manual Volume III	Appendix III-B Pages 102-119	[see deleted text]	[no text]
35.	Various revisions to text Chapter 1 – Introduction to volume IV	Improvements in text to add clarity	Drainage Manual Volume IV	Chapter 1, page 1	See Chapter 1 page 1	[various minor revisions]

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36.	Revised text related to Snohomish County code references in Chapter 2	Revised text is in accord with County code	Drainage Manual Volume IV	Chapter 2, page 3	If the source control BMPs described in this chapter and Chapter 3 are not sufficient to prevent prohibited discharges, Chapter 7.53 SCC requires the implementation of additional or more stringent BMPs as set forth in the Snohomish County Drainage Manual, or equivalent BMPs as allowed by the director of the Department of Planning and Development Services. These BMPs may include the source control BMPs described in Chapters 4 or 5 of this volume, erosion and sedimentation control BMPs described in Volume II, flow control BMPs described in Volume III, or treatment BMPs described in Volume V. For many properties and activities, the source control BMPs set forth in Chapters 2 and 3 of this volume will be the simplest and cheapest ways to prevent violations of Chapter 7.53 SCC. However, Chapter 7.53 SCC provides Snohomish County the authority to require implementation of structural source control or treatment BMPs in lieu of the BMPs in Chapter 2. Conversely, a person responsible for a discharge can propose alternative BMPs as equivalents to the director of Planning and Development Services.	If the source control BMPs described in this chapter and Chapter 3 are not sufficient to prevent prohibited discharges, Chapter 7.53 SCC requires the implementation of additional or more stringent BMPs as set forth in the Snohomish County Drainage Manual, or equivalent BMPs as allowed by either the director of the Department of Planning and Development Services or the director of the Department of Public Works. These BMPs may include the source control BMPs described in Chapters 4 or 5 of this volume, erosion and sedimentation control BMPs described in Volume II, flow control BMPs described in Volume III, or treatment BMPs described in Volume V. For many properties and activities, the source control BMPs set forth in Chapters 2 and 3 of this volume will be the simplest and cheapest ways to comply with Chapter 7.53 SCC. However, Chapter 7.53 SCC provides Snohomish County the authority to require implementation of structural source control or treatment BMPs in lieu of the BMPs in Chapter 2. Conversely, a person responsible for a discharge can propose alternative BMPs as equivalents to the director of Planning and Development Services or the director of the Department of Public Works or their designees.
37.	Revised text related to site maps	Revised text adds clarity	Drainage Manual Volume IV	Chapter 2.1, Prohibited Discharge Elimination, page 6	(Note: not required for noncommercial activities performed at residential properties) Maps showing storm sewers onsite may be held on file with Snohomish County Planning and Development Services – Records 425-388-3311 or through accessing publicly available drainage inventory maps via Snohomish County Surface Water Managements website.	Surface Water Management (SWM) maintains an interactive drainage inventory web map accessible through Snohomish County's webpage. Additionally, maps showing onsite stormwater systems may be held on file with Snohomish County Planning and Development Services. (Note: Site maps are not required for noncommercial activities performed at residential properties.) Hard copy files are available upon request from SWM at (425) 388-3464 and PDS-Records at (425) 388-3311.
38.	Revised text in Chapter 3.1 – BMPs for BMPs for the Building, Repair, and Maintenance of Boats and Ships	Revised text is in accord with County code	Drainage Manual Volume IV	Chapter 3.1, page 19	**NOTE:** All boatyards in Washington State with haul out facilities are required to be covered under the NPDES General Permit for Boatyard Activities. All shipyards in Washington State with haul out facilities such as drydocks, graving docks, marine railways or synchrolifts are required to be covered under an individual NPDES Permit. Any facility conducting boatyard or shipyard activities strictly from dockside, with no vessel haul out, must be covered by the NPDES General Stormwater Permit for Industrial Activities. Chapter 7.53 SCC states that full implementation of all BMPs required by an NPDES industrial stormwater permit shall constitute compliance with that code chapter.	**NOTE:** All boatyards in Washington State with haul out facilities are required to be covered under the NPDES General Permit for Boatyard Activities. All shipyards in Washington State with haul out facilities such as drydocks, graving docks, marine railways or synchrolifts are required to be covered under an individual NPDES Permit. Any facility conducting boatyard or shipyard activities strictly from dockside, with no vessel haul out, must be covered by the NPDES Industrial Stormwater General Permit for industrial activities. Chapter 7.53 SCC states that full implementation of all BMPs required by an NPDES industrial stormwater permit or State Waste Discharge Permit shall constitute compliance with that code chapter.

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39.	Revised text in Chapter 3.2 - BMPs for Commercial Animal Handling Areas	Added note to contact Snohomish County SWM	Drainage Manual Volume IV	Chapter 3.2, page 21	Contact the Snohomish Conservation District for more information.	Contact Snohomish County Surface Water Management and/or the Snohomish Conservation District for more information.
40.	Revised text in 3.10 - BMPs for Landscaping and Lawn/Vegetation Management at Commercial Sites or Performed Commercially at Other Sites	Revised text add reference to related BMPs 3.34 and 4.34	Drainage Manual Volume IV	Chapter 3.10, page 29	Although it is not required, pesticide and herbicide pollution can be minimized by developing and implementing an Integrated Pest Management (IPM) Plan.	Although it is not required, pesticide and herbicide pollution can be minimized by developing and implementing pest management, and in particular an Integrated Pest Management (IPM) Plan. (See BMPs 3.34 and 4.34.) I
41.	Added text to 3.24 - BMPs for Soil Erosion and Sediment Control at Industrial Sites	Added text is present in other BMP chapters but was not present in this chapter	Drainage Manual Volume IV	Chapter 3.24, page 46	[text not present]	Implementation of all BMPs required by an NPDES industrial stormwater permit or State Waste Discharge Permit is adequate to comply with Chapter 7.53 SCC unless these BMPs do not prevent prohibited discharges.
42.	Deleted text from Chapter 3.29 - BMPs for Washing and Steam Cleaning Vehicles, Equipment, and Building Structures	Text corrects a typo and reflects that Snohomish County no longer loans car wash pump kits	Drainage Manual Volume IV	Chapter 3.29, page 53	For infrequent non-standard activities such as charity car washed, a temporary wastewater collection and pumping system may be employed, such as a pump placed in a catch basin insert that pumps the wastewater to a sanitary sewer manhole. Such kits are available for loan from Snohomish County Surface Water Management. This type of wastewater collection system is not to be used for washing operations that are part of standard operations at a facility.	For infrequent non-standard activities such as charity car washes, a temporary wastewater collection and pumping system may be employed, such as a pump placed in a catch basin insert that pumps the wastewater to a sanitary sewer manhole. This type of wastewater collection system is not to be used for washing operations that are part of standard operations at a facility.
43.	Revised text in Chapter 4.1 – BMPs for BMPs for the Building, Repair, and Maintenance of Boats and Ships	Revised text is in accord with County code	Drainage Manual Volume IV	Chapter 4.1, page 89	**NOTE:** All boatyards in Washington State with haul out facilities are required to be covered under the NPDES General Permit for Boatyard Activities. All shipyards in Washington State with haul out facilities such as drydocks, graving docks, marine railways or synchrolifts are required to be covered under an individual NPDES Permit. Any facility conducting boatyard or shipyard activities strictly from dockside, with no vessel haul out, must be covered by the NPDES General Stormwater Permit for Industrial Activities. Chapter 7.53 SCC states that full implementation of all BMPs required by an NPDES industrial stormwater permit shall constitute compliance with that code chapter.	**NOTE:** All boatyards in Washington State with haul out facilities are required to be covered under the NPDES General Permit for Boatyard Activities. All shipyards in Washington State with haul out facilities such as drydocks, graving docks, marine railways or synchrolifts are required to be covered under an individual NPDES Permit. Any facility conducting boatyard or shipyard activities strictly from dockside, with no vessel haul out, must be covered by the NPDES Industrial Stormwater General Permit for industrial activities. Chapter 7.53 SCC states that full implementation of all BMPs required by an NPDES industrial stormwater permit or State Waste Discharge Permit shall constitute compliance with that code chapter.
44.	Revisions to Chapter 4.10 - BMPs for Landscaping and Lawn/Vegetation Management at	Revision adds reference to BMP 4.34. Reference	Drainage Manual Volume IV	Chapter 4.10, Pages 99-100	• Consider developing and implementing an Integrated Pest Management (IPM) Plan (See section on IPM at end of BMP) and use pesticides only as a last resort.	• Consider developing and implementing an Integrated Pest Management (IPM) Plan (See BMP 4.34) and use pesticides only as a last resort.

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	Commercial Sites or Performed Commercially at Other Sites	makes deleted text superfluous.			• Implement a pesticide-use plan and include at a minimum: a list of selected pesticides and their specific uses; brands, formulations, application methods and quantities to be used; equipment use and maintenance procedures; safety, storage, and disposal methods; and monitoring, record keeping, and public notice procedures. Refer to Chapter 17.21 RCW and Chapter 16-228 WAC. • Consider choosing the least toxic pesticide available that is capable of reducing the infestation to acceptable levels. Any method used should be site-specific and not used wholesale over a wide area. • Consider alternatives to the use of pesticides such as covering or harvesting weeds, substitute vegetative growth, and manual weed control/moss removal. • Consider the use of soil amendments, such as compost, that are known to control some common diseases in plants, such as Pythium root rot, ashy stem blight, and parasitic nematodes. The following are three possible mechanisms for disease control by compost addition (USEPA Publication 530-F-9-044): 1. Successful competition for nutrients by antibiotic production; 2. Successful predation against pathogens by beneficial microorganism; and 3. Activation of disease-resistant genes in plants by composts. • Installing an amended soil/landscape system can preserve both the plant system and the soil system more effectively. This type of approach provides a soil/landscape system with adequate depth, permeability, and organic matter to sustain itself and continue working as an effective stormwater infiltration system and a sustainable nutrient cycle. • Once a pesticide is applied, its effectiveness should be evaluated for possible improvement. Records should be kept showing the applicability and inapplicability of the pesticides considered. • An annual evaluation procedure should be developed including a review of the effectiveness of pesticide applications, impact on buffers and sensitive areas (including	

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					potable wells), public concerns, and recent toxicological information on pesticides used/proposed for use. If individual or public potable wells are located in the proximity of commercial pesticide applications contact the regional Ecology hydrogeologist to determine if additional pesticide application control measures are necessary. • For more information, contact the WSU Extension Home-Assist Program, (253) 445-4556, or Bio-Integral Resource Center (BIRC), P.O. Box 7414, Berkeley, CA.94707, or the Washington Department of Ecology to obtain "Hazardous Waste Pesticides" (Publication #89-41); and/or EPA to obtain a publication entitled "Suspended, Canceled and Restricted Pesticides" which lists all restricted pesticides and the specific uses that are allowed. Valuable information from these sources may also be available on the internet.	
45.	Revisions to Chapter 4.10 - BMPs for Landscaping and Lawn/Vegetation Management at Commercial Sites or Performed Commercially at Other Sites	Deleted text is repeated elsewhere in Volume IV	Drainage Manual Volume IV	Chapter 4.10, Page 102	<u>Integrated Pest Management</u> An IPM program might consist of the following steps: Step 1: Correctly identify problem pests and understand their life cycle Step 2: Establish tolerance thresholds for pests. Step 3: Monitor to detect and prevent pest problems. Step 4: Modify the maintenance program to promote healthy plants and discourage pests. Step 5: Use cultural, physical, mechanical, or biological controls first if pests exceed the tolerance thresholds. Step 6: Evaluate and record the effectiveness of the control and modify maintenance practices to support lawn or landscape recovery and prevent recurrence.	[text deleted]
46.	New BMP 4.30 - BMPs for Wood Treatment Facilities	Added section for consistency in numbering	Drainage Manual Volume IV	Chapter 4.30, page 124	[no text]	**NOTE:** A wood treatment facility is required to operate under an individual NPDES stormwater permit. Chapter 7.53 SCC states that full implementation of all BMPs required by an NPDES industrial stormwater permit shall constitute compliance with that code chapter.

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						Description of Pollutant Sources Wood treatment includes both antistaining and wood preserving using pressure processes or by dipping or spraying. Wood preservatives include creosote, creosote/coal tar, pentachlorophenol, copper naphthenate, arsenic trioxide, malathion, or inorganic arsenicals such as chromated copper arsenate, acid copper chromate, chromate zinc chloride, and fluor-chrome-arsenate-phenol. Anti-staining chemical additives include iodo-prophenyl-butyl carbamate, dimethyl sulfoxide, didecyl dimethyl ammonium chloride, sodium azide, 8-quinolinol; copper (II) chelate, sodium ortho-phenylphenate, 2-(thiocyanomethylthio)-benzothiazole (TCMTB) and methylene bis-(thiocyanate), and zinc naphthenate. Pollutant sources include drips of condensate or preservative after pressurized treatment; product washwater (in the treatment or storage areas), spills and leaks from process equipment and preservative tanks, fugitive emissions from vapors in the process, blowouts and emergency pressure releases, and kick-back from lumber (phenomenon where preservative leaks as it returns to normal pressure). Potential pollutants typically include the wood treating chemicals, BOD, suspended solids, oil and grease, benzene, toluene, ethylbenzene, phenol, chlorophenols, nitrophenols, heavy metals, and PAH depending on the chemical additive used. **Recommended Source Control BMPs:** All source control BMPs for this activity/land use are required and found in section 3.30.

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47.	4.31 BMPs for Swimming Pool and Spa Maintenance	Added section for consistency in numbering	Drainage Manual Volume IV	Chapter 4.32, page 125	[no text]	**Description of Pollutant Sources** The primary pollutants of concern in water found in swimming pools and spas are chlorine and bromine compounds, which are used as disinfectants and algicides. Algicides may also contain copper. Snohomish County Code Chapter 7.53 allows the discharge of water from swimming pools and spas, other than swimming pool cleaning wastewater and filter backwash, provided that the discharge: • contains less than 0.1 milligram per liter of chlorine; • does not contain algicides other than chlorine or bromine; • does not contain other contaminants, including but not limited to algae, solids, excessively high or low pH, and hypoxic water; and; • is thermally controlled as necessary to prevent an increase in temperature of the receiving water. In addition, the discharge rate must be controlled in order to avoid resuspension and transport of sediment in downstream drainage systems. **Recommended Source Control BMPs:** All source control BMPs for this activity/land use are required and found in section 3.31.
48.	Moved 4.30 – BMPs for Privately-Owned Roads and Streets and renumbered it 4.49	Moved for document clarity	Drainage Manual Volume IV	Chapter 4.49, moved from page 126 to 155	[text moved from page 126 to 155 with no change to content]	[text moved from page 126 to 155 with no change to content]
49.	Revision to 5.2.1 - BMPs for the Building, Repair, and Maintenance of Boats and Ships	Revised text is in accord with County code	Drainage Manual Volume IV	Chapter 5.2.1, page 174	**NOTE:** All boatyards in Washington State with haul out facilities are required to be covered under the NPDES General Permit for Boatyard Activities. All shipyards in Washington State with haul out facilities such as drydocks, graving docks, marine railways or synchrolifts are required to be covered under an individual NPDES Permit. Any facility conducting boatyard or shipyard activities strictly from dockside, with no vessel haul out, must be covered by the NPDES General Stormwater Permit for Industrial Activities. Chapter 7.53 SCC states that full implementation of all BMPs	**NOTE:** All boatyards in Washington State with haul out facilities are required to be covered under the NPDES General Permit for Boatyard Activities. All shipyards in Washington State with haul out facilities such as drydocks, graving docks, marine railways or synchrolifts are required to be covered under an individual NPDES Permit. Any facility conducting boatyard or shipyard activities strictly from dockside, with no vessel haul out, must be covered by the NPDES Industrial Stormwater General Permit for industrial activities. Chapter 7.53 SCC states that full implementation of all

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					required by an NPDES industrial stormwater permit shall constitute compliance with that code chapter.	BMPs required by an NPDES industrial stormwater permit or State Waste Discharge Permit shall constitute compliance with that code chapter.
50.	Revision to Chapter 1.4.2, Maintenance	Revised text adds reference to new Volume VI	Drainage Manual Volume V	Chapter 1.4.2 Maintenance, page 2	Maintenance requirements for drainage facilities are set forth in Chapter 7.54 SCC and Chapter 4.6 of this volume.	Maintenance requirements and standards for drainage facilities are set forth in Chapter 7.54 SCC, Chapter 4.6 of this volume, and Volume VI of this manual.
51.	Revision to Chapter 4.1.1 - Water Quality Design Storm Volume	Replaced text adds reference to information presented in Volume III	Drainage Manual Volume V	Chapter 4.1.1, page 6	The water quality design storm volume is the volume of runoff predicted from a 24-hour storm with a 6-month return frequency, or, alternatively, the 91st percentile, 24-hour runoff volume indicated by an approved continuous runoff model. Wetpool facilities are sized based upon use of the NRCS (formerly known as SCS) curve number equations in Volume III, Chapter 2 for the 6-month, 24-hour storm. Treatment facilities sized by this simple runoff volume-based approach are the same size whether they precede detention, follow detention, or are integral with the detention facility (i.e., a combined detention and wetpool facility). Unless amended to reflect local precipitation statistics, the 6-month, 24-hour precipitation amount may be assumed to be 72 percent of the 2-year, 24-hour amount. Precipitation estimates of the 6-month and 2-year, 24-hour storms for certain towns and cities are listed in Volume I, Appendix I-B. For other areas, interpolating between isopluvials for the 2-year, 24-hour precipitation and multiplying by 72% yields the appropriate storm size. Isopluvials for 2-year, 24-hour amounts for Western Washington are reprinted in Volume III.	See Volume III, Chapter 2 for water quality design volume determination.
52.	Revision to Chapter 4.1.2 - Water Quality Design Flow Rate	Replaced text adds reference to information presented in Volume III	Drainage Manual Volume V	Chapter 4.1.2, page 6	The water quality design flow rate for treatment systems downstream of detention facilities is the full 2-year release rate from the detention facility. The water quality design flow rate for treatment systems upstream of detention facilities, or for projects in which detention is not required, is the flow rate at or below which 91% of the runoff volume, as estimated by an approved continuous runoff model, will be treated. All BMPs except wetpool-types shall use the 15-minute time series from an approved continuous runoff model.	See Volume III, Chapter 2 for information on approved continuous runoff hydrologic models for determining the water quality design flow rate.

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					Design criteria for treatment facilities are assigned to achieve the applicable performance goal at the water quality design flow rate (e.g., 80 percent TSS removal). For treatment facilities not preceded by an equalization or storage basin, and when runoff flow rates exceed the water quality design flow rate, the treatment facility should continue to receive and treat the water quality design flow rate to the applicable treatment performance goal. Only the higher incremental portions of flow rates are bypassed around a treatment facility. Snohomish County encourages design of systems that engage a bypass at higher flow rates provided the reduction in pollutant loading exceeds that achieved with bypass at the water quality design flow rate. Treatment facilities preceded by an equalization or storage basin may identify a lower water quality design flow rate provided that at least 91 percent of the estimated runoff volume in the time series of an approved continuous runoff model is treated to the applicable performance goals (e.g., 80 percent TSS removal at the water quality design flow rate and 80 percent TSS removal on an annual average basis). Runoff flow rates in excess of the water quality design flow rate can be routed through the facility provided a net pollutant reduction is maintained.	
53.	Revision to Chapter 4.1.4 - Minimum Treatment Facility Size	Revision removes ambiguous references to a criterion, and adds statement about minimum facility size	Drainage Manual Volume V	Chapter 4.1.4, page 7	The minimum design flow rate for treatment facilities based on this criterion is 0.0081 cfs. The minimum design volume for treatment facilities based on this criterion is 405 cf.	The minimum design flow rate for treatment facilities is 0.0081 cfs. The minimum design volume for treatment facilities is 405 cf. No BMP shall be designed smaller than that required to accommodate the minimum flow rate or volume.
54.	Revision to Chapter 4.5.1 - Flow Splitter Designs	Revisions clarify reference to approved hydrologic model	Drainage Manual Volume V	Chapter 4.5.1, page 14	• A flow splitter must be designed to deliver the WQ design flow rate specified in this volume to the WQ treatment facility. For the basic size sand filter, which is sized based on volume, use the WQ design flow rate to design the splitter. For the large sand filter, use the 2-year flow rate or the flow rate that corresponds with treating 95 percent of the runoff volume of a long-term time series predicted by an approved continuous runoff model. • The top of the weir must be located at the water surface for the design flow. Remaining flows enter the bypass line. Flows	• A flow splitter must be designed to deliver the WQ design flow rate to the WQ treatment facility. For the basic size sand filter, which is sized based on volume, use the WQ design flow rate to design the splitter. For the large sand filter, use the 2-year flow rate or the flow rate that corresponds with treating 95 percent of the runoff volume of a long-term time series predicted by an approved continuous runoff hydrologic model. • The top of the weir must be located at the water surface for the design flow. Remaining flows enter the bypass line.

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					modeled using a continuous simulation model should use 15-minute time steps, if available. Otherwise use 1-hour time steps.	
55.	Revisions to Chapter 4.6.1 - Purpose	Revisions add reference to new Volume VI and add clarifying text	Drainage Manual Volume V	Chapter 4.6.1, page 22	The purpose of this chapter is to set forth maintenance standards for different components of drainage facilities and catch basins. These standards match specific facility components and features with approved uniform maintenance procedures. The facility-specific maintenance standards contained in this section are intended to be conditions for determining if maintenance actions are required, as identified through inspection. The following definitions apply to maintenance described in this chapter. "Drainage facility" means a catch basin or stormwater flow control or treatment facility described in Table 5.3 of this chapter. "Maintenance" for this chapter shall be used to mean regular maintenance, repair or replacement actions. The maintenance standards are not intended to be measures of a facility's required condition at all times between inspections. In other words, if these conditions are exceeded at any time between inspections and/or maintenance, this does not automatically constitute a violation of these standards.	The purpose of this chapter is to set forth maintenance requirements for stormwater facilities including catch basins. The requirements include maintenance standards provided in Volume VI Stormwater Facility Maintenance. For each specific facility components and features the approved uniform maintenance standards are listed. The facility-specific maintenance requirements are intended to be conditions for determining if maintenance actions are required, as identified through inspection. The following definitions apply to maintenance described in this chapter and Volume VI. "Stormwater facility," for the purposes of this chapter and Volume VI, means a catch basin or stormwater flow control or treatment facility, including components and access, described in Tables 1 through 27 in Volume VI of this manual. "Maintenance" for this chapter and Volume VI shall be used to mean regular maintenance, repair or replacement actions. The maintenance standards are not intended to be measures of a facility's required condition at all times between inspections. In other words, if these conditions are exceeded at any time between inspections and/or maintenance, this does not automatically constitute a violation of these standards.
56.	Revisions to Chapter 4.6.2 – Applicability	Clarifications about applicability	Drainage Manual Volume V	Chapter 4.6.2, page 22	This chapter applies to drainage facilities identified in Table 5.3 of this chapter that are owned or operated by Snohomish County, catch basins owned or operated by the County, and such drainage facilities and catch basins owned by other entities.	This chapter applies to stormwater facilities identified in Table 5.3 of this chapter that are owned or operated by Snohomish County, catch basins owned or operated by the County, and such stormwater facilities and catch basins owned by other entities or individuals.
57.	Revisions to Chapter 4.6.3 – Enforcement	Revisions add reference to new Volume VI and add clarifying text	Drainage Manual Volume V	Chapter 4.6.3, page 22	Chapter 7.54 Snohomish County Code (SCC) requires any owner or operator of a drainage facility described in this chapter to maintain the facility in accordance with the standards set forth in this chapter.	Chapter 7.54 SCC requires any owner or operator of a stormwater facility described in this chapter to maintain the facility in accordance with the requirements and standards set forth in this chapter and Volume VI.
58.	Revisions to Chapter 4.6.4 - Tracking Maintenance and Repair Costs	Clarifications about requirements for cost tracking	Drainage Manual Volume V	Chapter 4.6.4, page 22	Chapter 7.54 SCC requires that owners and operators of stormwater facilities keep records of their maintenance actions for their stormwater facilities. In addition, Snohomish County	Chapter 7.54 Snohomish County Code (SCC) requires property owners to keep records of their maintenance actions for their drainage facilities. In addition, Snohomish County requests that

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					requests that these owners and operators to track the cost of maintenance and provide that information to the County. However, the request for cost information is not a regulatory requirement. The information will be used by the County to estimate general maintenance and repair cost information, in order to provide useful data to members of the public, including homeowners associations, who may need to plan and budget for maintenance services. The County does not intend to provide cost information that can be traced to a specific facility.	owners and operators of drainage facilities track the cost of maintenance and repairs and provide these costs to the County. The request for cost information is not a regulatory requirement. The information will be used by the County to estimate general maintenance and repair cost information and to provide that information to members of the public who may need to perform such work and estimate costs. The County does not intend to provide cost information that can be traced to a specific facility.
59.	Revision to introductory text in Chapter 4.6.6 – Maintenance Standards	Standards are now set forth in new Volume VI	Drainage Manual Volume V	Chapter 4.6.6, Maintenance, page 25	Maintenance standards are set forth in Table 5.3.	Maintenance standards are set forth in Tables 1 through 27 of Volume VI Stormwater Facility Maintenance. Below Table 5.3 lists all the stormwater facilities that are described in Volume VI.
60.	Revision to Chapter 4.6.6 – Maintenance Standards	Standards are now set forth in new Volume VI	Drainage Manual Volume V	Chapter 4.6.6, Maintenance, page 26	[deleted tables of standards, which are now presented in Volume VI]	**Table 5.3 – Stormwater Facilities with Maintenance Standards** **(See Volume VI for Maintenance Standards)** No. 1 Catch Basins No. 2 Conveyance Storm Pipes No. 3 Debris Barriers (e.g., Trash Racks) No. 4 Control Structure/Flow Restrictors No. 5 Facility Discharge Points No. 6 Energy Dissipaters No. 7 Detention Ponds No. 8 Underground Detention Pipes/Tanks No. 9 Infiltration Facilities No. 10 Wetponds No. 11 Wetvaults No. 12 Bioretention Systems No. 13 Typical Biofiltration Swales No. 14 Wet Biofiltration Swales No. 15 Compost Amended Vegetated Filter Strip (CAVFS) No. 16 Media Filter Drain No. 17 Filter Strips No. 18 Sand Filters (above ground/open) No. 19 Sand Filters (below ground/enclosed) No. 20 Permeable Pavement No. 21 Vegetated Roofs No, 22 Media Filter Cartridge No. 23 Hydrodynamic Separators No. 24 API Baffle Oil/Water Separators

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						No. 25 Coalescing Plate Oil/Water Separators No. 26 Catchbasin Inserts No. 27 Access Gates No. 28 Access Roads
61.	Revision to maintenance standards	Added reference to maintenance standard section for vegetated roofs, based on BMP T5.17 in 2019 Ecology SWMMWW.	Drainage Manual Volume V	Chapter 4.6.6, Maintenance, page 26	[no text]	No. 21 Vegetated Roofs [Note: text and figures for maintenance standards appear in new Drainage Manual Volume VI]
62.	Revisions to BMP T5.11 Concentrated Flow Dispersion	Revisions to hydrologic modeling reflect information in 2019 Ecology SWMMWW and reference updated modeling requirements	Drainage Manual Volume V	Chapter 5.3, pages 61-62	**Hydrologic modeling credit for concentrated flow dispersion** Where BMP T5.11 is used to disperse runoff into an undisturbed native landscape area or an area that meets BMP T5.13 (Post-Construction Soil Quality and Depth), and the vegetated flow path is at least 50 feet, the impervious area may be modeled as landscaped area. Where the vegetated flowpath is 25 – 50 feet, using a dispersion trench (see BMP T5.10B) allows modeling the impervious area as 50% impervious/50% landscape. This is done in the WWHM 3 on the Mitigated Scenario screen by entering the dispersed impervious area into one of the entry options for dispersal of impervious area runoff. For procedures in WWHM 2012, see Volume III, Appendix III-C	**Runoff model representation** Where BMP T5.11 is used to disperse runoff into an undisturbed native landscape area or an area that meets BMP T5.13 (Post-Construction Soil Quality and Depth), the impervious area should be modeled as a lateral flow impervious basin connected to a lawn/landscape lateral flow basin which represents the area used for dispersion. Alternatively, where multiple instances of concentrated flow dispersion will occur the following methods may be used. • If the vegetated flow path is at least 50 feet, the impervious area may be modeled as landscaped area. • Where the vegetated flowpath is 25 – 50 feet, using a dispersion trench (see BMP T5.10B) allows modeling the impervious area as 50% impervious/50% landscape.
63.	Revisions to BMP T5.12 SheetFlow Dispersion	Revisions to hydrologic modeling reflect information in 2019 Ecology SWMMWW and reference updated modeling requirements	Drainage Manual Volume V	Chapter 5.3, page 65	**Hydrologic modeling credit for sheet flow dispersion** Where BMP T5.12 is used to disperse runoff into an undisturbed native landscape area or an area that meets BMP T5.13, and the vegetated flow path is 50 feet or more, the impervious area may be modeled as landscaped area. Where the vegetated flowpath is 25 to 50 feet, use of a dispersion trench (see BMP T5.10B) allows modeling the impervious area as 50% impervious/50% landscape. This is done in the WWHM3 on the Mitigation Scenario screen by entering the dispersed impervious area into one of the entry options for dispersal of impervious area runoff. For procedures in WWHM 2012, see Appendix III-C in Volume III.	**Runoff model representation** Where BMP T5.12 is used to disperse runoff into an undisturbed native landscape area or an area that meets BMP T5.13, the impervious area should be modeled as a lateral flow impervious basin connected to a lawn/landscape lateral flow basin which represents the area used for dispersion.

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64.	Revisions to BMP T5.13 Post Construction Soil Quality and Depth	Requirements relate to construction and are not maintenance requirements	Drainage Manual Volume V	Chapter 5.3, page 69	Maintenance • Soil quality and depth should be established toward the end of construction and, once established, should be protected from compaction, such as from large machinery use, and from erosion. • Soil should be planted and mulched after installation. • Plant debris or its equivalent should be left on the soil surface to replenish organic matter.	Construction • Soil quality and depth should be established toward the end of construction and, once established, should be protected from compaction, such as from large machinery use, and from erosion. • Soil should be planted and mulched after installation. • Plant debris or its equivalent should be left on the soil surface to replenish organic matter.
65.	Revisions to BMP T5.13 Post Construction Soil Quality and Depth	Revisions to hydrologic modeling reflect information in 2019 Ecology SWMMWW and reference updated modeling requirements	Drainage Manual Volume V	Chapter 5.3, page 69	**Flow Reduction Credits** Areas meeting the design requirements above can be modeled as "Pasture." Flow reduction credits can be taken in runoff modeling when BMP T5.13 is used as part of a dispersion design under the conditions described in: • BMP T5.10B Downspout Dispersion Systems • BMP T5.11 Concentrated Flow Dispersion • BMP T5.12 Sheet Flow Dispersion • BMP T5.18 Reverse Slope Sidewalks • BMP T5.30 Full Dispersion (for public road projects) • Non-pollution-generating impervious surface dispersion BMPs in Volume III, Chapter 3 of this manual.	**Runoff model representation** All areas meeting the soil quality and depth design criteria may be entered into approved runoff hydrologic models as pasture rather than lawn/landscaping. This includes impervious surfaces modeled as pervious for the following BMPs: • BMP T5.10B Downspout Dispersion Systems • BMP T5.11 Concentrated Flow Dispersion
66.	Revisions to BMP T5.14A – Rain Gardens	Revisions refer to new Volume VI	Drainage Manual Volume V	Chapter 5.3, page 71	Use applicable sections of bioretention system maintenance methods set forth in Chapter 4.6 of this volume.	See the requirements set forth in Chapter 4.6 of this volume and in applicable bioretention system maintenance standards in Volume VI Stormwater Facility Maintenance.
67.	Revisions to BMP T5.14B – Bioretention for On-Site Stormwater Management	Revisions refer to new Volume VI	Drainage Manual Volume V	Chapter 5.3, page 73	See maintenance criteria for bioretention in Chapter 4.6 of this volume.	See the requirements set forth in Chapter 4.6 of this volume and in applicable bioretention system maintenance standards in Volume VI Stormwater Facility Maintenance.
68.	Revisions to BMP T5.15 – Permeable Pavement	Revisions to hydrologic modeling reflect information in 2019 Ecology SWMMWW and reference updated	Drainage Manual Volume V	Chapter 5.3, page 77	**Hydrologic modeling credits** Model permeable pavement that has storage in a base course below the wearing surface using the permeable pavement element in the model. Areas of permeable pavement with similar pavement type / design and similar infiltration characteristics can	**Runoff model representation** Note that if the project is using permeable pavement to only meet BMP list approach within Minimum Requirement 5, there is no need to model the permeable pavement in a continuous runoff model.

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		modeling requirements			be summed and represented in the model as a single area of permeable pavement with the following characteristics: • drainage area = combined drainage areas of the individual paved areas; • ponded area = combined ponded areas of the individual paved areas; • design infiltration rate = weighted average design infiltration rate, weighted by size of paved area. Model permeable pavement with no storage in a base course below the wearing surface as lawn/landscape. See Appendix III-C for runoff modeling guidance under WWHM3 and under WWHM 2012.	The following information shall be used to comply with the LID Performance Standard in Minimum Requirement 5, or the standards in Minimum Requirements 6, 7, and/or 8. Continuous runoff modeling software include specific modeling elements for use in modeling the permeable pavement. Within these elements, the model user specifies pavement thickness and porosity, aggregate base material thickness and porosity, maximum allowed ponding depth, and the infiltration rate into the native soil. • For grades less than 2%, no adjustment to the below ground volumes are necessary. • For grades greater than 2% without internal dams within the base materials, the below ground storage volume must be adjusted as follows: o Permeable pavement surfaces that are below the surrounding grade and that are on a slope can be modeled as permeable pavement with an infiltration rate and a nominal depth. o The dimensions of the permeable pavement are: the length (parallel to and beneath the road) of the base materials that are below grade; the width of the below grade base materials; and an Effective Total Depth of 1 inch. If the continuous runoff model requires the permeable pavement to have an overflow riser to model overflows that occur should the available storage get exceeded, enter 0.04 ft (1/2 inch) for the "Riser Height" and a large Riser Diameter (say 1000 inches) to ensure that there is no head build up. o If a drainage pipe is embedded and elevated in the below grade base materials, the pipe should only have perforations on the lower half (below the spring line) or near the invert. Pipe volume and trench volume above the pipe invert cannot be assumed as available storage space. If a drainage pipe is placed at the bottom of the base material, the pavement is modeled as an impervious surface without any gravel trench. • For roads on a slope with internal dams within the base materials that are below grade, the below ground storage volume must be adjusted as follows:

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						○ Each stretch of permeable pavement (cell) that is separated by barriers can be modeled separately. For each cell, determine the average depth of water within the cell at which the barrier at the lower end will be overtopped. ○ Specify the dimensions of each cell of the below-grade base materials using the permeable pavement dimension fields for: the “Pavement Length” (length of the cell parallel to the road); the “Pavement Bottom Width”(width of the bottom of the base material); and the Effective Total Depth. In WWHM2012, the field entilted “Effective Volume Factor” is used by the program to calculate the effective storage volume within the below-grade base materials for roads on a slope. The Effective Volume Factor is the ratio of the average maximum water depth behind a check dam (typically at the middle of the pavement length) to the below-grade base materials depth. ○ Each cell should have its own tributary drainage area within the permeable pavement element that includes the road above it, any project site areas whose runoff drains onto and through the road (lateral flow soil or impervious basin), and any off-site areas. Represent each drainage area with a permeable pavement icon and a lateral flow basin icon (if runon occurs). In the runoff modeling, similar designs throughout a development can be summed and represented as one large facility. For instance, walkways can be summed into one facility. Driveways with similar designs (and enforced through deed restrictions) can be summed into one facility. In these instances, a weighted average of the design infiltration rates (where within a factor of two) for each location may be used. The averages are weighted by the size of their drainage area. The design infiltration rate for each site is the measured Ksat multiplied by the appropriate correction factors. Within WWHM2012, on the Permeable Pavement screen under “Infiltration”, there is a field that asks the following “Use Wetted Surface Area?” By default, it is set to “NO”. It should stay “NO” if the below-grade base material trench has sidewalls steeper than 2 horizontal to 1 vertical.

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69.	Revisions to BMP T5.15 – Permeable Pavement	Revisions refer to new Volume VI	Drainage Manual Volume V	Chapter 5.3, page 79	Permeable pavement maintenance requirements are set forth in Chapter 4.6 of this volume.	See the requirements and standards set forth in Chapter 4.6 of this volume, and in Volume VI Stormwater Facility Maintenance.
70.	Revisions to BMP T5.30 Full Dispersion	Revisions clarify modeling requirements	Drainage Manual Volume V	Chapter 5.3 page 87	**Hydrologic modeling credits** Areas that are fully dispersed do not use the WWHM or other approved continuous runoff models.	**Runoff model representation** Areas that are fully dispersed do not have to use approved runoff models to demonstrate compliance. They are presumed to fully meet the Runoff Treatment and Flow Control requirements in Minimum Requirements 6 and 7.
71.	Revisions to BMP T5.16 - Tree Retention and Tree Planting	Added text clarifies modeling requirements	Drainage Manual Volume V	Chapter 5.4, page 91	[no existing text]	**Runoff model representation** If the design criteria for this BMP are followed, the total impervious/hard surface areas entered into the runoff model may be reduced by the amount indicated in the design criteria above.
72.	Revisions to BMP T5.17 – Vegetated Roofs	Revised text reflects updated modeling requirements in Ecology 2019 SWMMWW	Drainage Manual Volume V	Chapter 5.4, page 92	**Hydrologic modeling credits** See Appendix III-C in Volume III for a summary of how vegetated roofs may be entered into the approved continuous runoff models.	**Runoff model representation** When modeling the project using an approved continuous runoff model, use the element intended by the modeling software to represent a vegetated roof. If using WWHM2012, this is the "green roof" element. The user specifies the media thickness, vegetation type, roof slope, and length of drainage within the model.
73.	Revisions to BMP T5.17 – Vegetated Roofs	Added maintenance standard for vegetated roofs	Drainage Manual Volume V	Chapter 5.4, page 92	[no text]	See the requirements and standards set forth in Chapter 4.6 of this volume, and in Volume VI Stormwater Facility Maintenance.
74.	Revisions to BMP T5.18 – Reverse Slope Sidewalks	Revised text reflects updated modeling requirements in Ecology 2019 SWMMWW	Drainage Manual Volume V	Chapter 5.4, page 93	**Hydrologic modeling credits** In WWHM 3, enter sidewalk area as lawn/landscaped area over the underlying soil type. For WWHM 2012, see Volume III, Appendix III-C.	**Runoff model representation** Use the lateral flow element of an approved continuous runoff hydrologic model to send the impervious area runoff onto the lawn/landscape area that will be used for dispersion. For situations where multiple reverse slope sidewalks will occur the impervious area may be modeled as a landscaped area so that the project schematic in the model is manageable.
75.	Revisions to BMP T5.19 – Minimal Excavation Foundations	Revised text clarifies purpose and applications	Drainage Manual Volume V	Chapter 5.4, page 94	**Purpose and definition** Low impact foundations are defined as those techniques that do not disturb, or minimally disturb the natural soil profile within the footprint of the structure. This preserves most of the hydrologic	**Purpose and definition** Minimal excavation foundations are defined as those foundation technologies that engage intact existing soil strength with minimal or no excavation, and do not disturb, or significantly compact the

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					properties of the native soil. Pin foundations are an example of a minimal excavation foundation. **Applications and limitations** Building foundations must comply with all applicable requirements of Snohomish County development codes To minimize soil compaction, heavy equipment cannot be used within or immediately surrounding the building. Terracing of the foundation area may be accomplished by tracked, blading equipment not exceeding 650 psf.	natural soil profile within the footprint of the structure when installed. This preserves most of the hydrologic properties of the native soil. Pin pile, screw pile, and cluster pile foundations are examples of minimal excavation foundations, as well as post and beam, grade beam or fin wall structures. **Applications and limitations** Building foundations must comply with all applicable requirements of Snohomish County development codes To minimize soil compaction, heavy equipment, including pile driving equipment that would degrade the natural soil profile's ability to retain, drain and/or filter stormwater cannot be used within or immediately surrounding the building. Tracked equipment weighing 650 psf or less is acceptable.
76.	Revisions to BMP T5.19 – Minimal Excavation Foundations	Revised text reflects updated modeling requirements in Ecology 2019 SWMMWW	Drainage Manual Volume V	Chapter 5.4, page 94	Where residential roof runoff is dispersed on the up gradient side of a structure in accordance with the design criteria and guidelines in BMP T5.10B, the tributary roof area may be modeled as pasture on the native soil. Where "step forming" is used on a slope, the square footage of roof that can be modeled as pasture must be reduced to account for lost soils. In "step forming," the building area is terraced in cuts of limited depth. This results in a series of level plateaus on which to erect the form boards. The following equation can be used to reduce the roof area that can be modeled as pasture. $A_1 - \frac{dC(.5)}{dP} \times A_1 = A_2$ A_1 = roof area draining to up gradient side of structure dC = depth of cuts into the soil profile dP = permeable depth of soil (The A horizon plus an additional few inches of the B horizon where roots permeate into ample pore space of soil). A_2 = roof area that can be modeled as pasture on the native soil If roof runoff is dispersed down gradient of the structure in accordance with the design criteria and guidelines in BMP T5.10B,	Where residential roof runoff is dispersed on the up gradient side of a structure in accordance with the design criteria and guidelines in BMP T5.10B, the tributary roof area may be modeled as pasture on the native soil, provided the dispersed runoff is not cut off by an embedded grade beam, wall, or skirt structure from reaching the preserved permeable soils below the building. If roof runoff is dispersed down gradient of the structure in accordance with the design criteria and guidelines in BMP T5.10B, AND there is at least 50 feet of vegetated flow path through native material or lawn/landscape area that meets the guidelines in BMP T5.13, the tributary roof areas may be modeled as lawn/landscaped area. Where terracing on a slope below the building or vegetated flow path, as defined above, is necessary for construction, the square footage of roof that can be modeled as pasture or lawn/landscaped area must be reduced to account for lost permeable soils. The roof area modeled as pasture or lawn/landscape shall be reduced by the same percentage as that of the permeable soils in the slope below the structure or within the down gradient flow path that are removed by the terracing.

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					AND there is at least 50 feet of vegetated flow path through native material or lawn/landscape area that meets the guidelines in BMP T5.13, the tributary roof areas may be modeled as lawn/landscaped area.	
77.	Revisions to BMP T5.20 Rainwater Harvesting	Revisions organize information better and refer to current modeling requirements	Drainage Manual Volume V	Chapter 5.4, page 96	**Design criteria** 100% reuse of the annual average runoff volume (use continuous runoff model to get annual average for drainage area) System designs involving interior uses must have a monthly water balance that demonstrates adequate capacity for each month and reuse of all stored water annually. **Hydrologic modeling credits** Do not enter drainage area into the runoff model. **Other criteria** Restrict use to 4 homes/acre housing and lower densities when the captured water is solely for outdoor use.	**Design criteria** In order to use the guidance below for Runoff Model Representation, the design must show 100% reuse of the annual average runoff volume. The designer must use an approved continuous runoff hydrologic model to calculate the annual average runoff volume for the drainage area. System designs involving interior uses must have a monthly water balance that demonstrates adequate capacity for each month and reuse of all stored water annually. Restrict the use of this BMP to 4 homes/acre housing and lower densities when the captured water is solely for outdoor use. **Runoff model representation** If the design criteria for this BMP are followed, the area draining to the rainwater harvesting BMP is not entered into the runoff model.
78.	Revisions to BMP T7.30 – Bioretention Cells, Swales, and Planter Boxes	Revisions to modeling requirements match Ecology 2019 SWMMWW	Drainage Manual Volume V	Chapter 7.3, page 111	<u>Determining Bioretention soil mix infiltration rate</u> The WWHM's default infiltration rate of 12 inches per hour may be used for the Bioretention Soil Mix recommended herein. If creating a custom bioretention soil mix, Use ASTM D 2434 Standard Test Method for Permeability of Granular Soils (Constant Head) with a compaction rate of 85 percent using ASTM D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort. See Appendix V-B for specific procedures for conducting ASTM D 2434. The WWHM user must enter the derived value into WWHM using "View/Edit Soil Types" pull down menu and adjusting the Ksat value. Determine the appropriate safety factor for the saturated hydraulic conductivity (Ksat). If the contributing area of the bioretention cell or swale is equal to or exceeds any of the	<u>Determining Bioretention soil mix infiltration rate</u> The default infiltration rate of 12 inches per hour may be used for the Bioretention Soil Mix recommended herein. If creating a custom bioretention soil mix, Use ASTM D 2434 Standard Test Method for Permeability of Granular Soils (Constant Head) with a compaction rate of 85 percent using ASTM D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort. See Appendix V-B for specific procedures for conducting ASTM D 2434. The designer must enter the derived Ksat value into the approved continuous runoff hydrologic model. Determine the appropriate safety factor for the saturated hydraulic conductivity (Ksat). If the contributing area of the bioretention cell or swale is equal to or exceeds any of the following limitations, use 4 as the infiltration rate (Ksat) safety factor:

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					following limitations, use 4 as the infiltration rate (Ksat) safety factor: • 5,000 square feet of pollution-generating impervious surface; • 10,000 square feet of impervious surface; or • ¾ acre of lawn and landscape. If the contributing area is less than all of the above areas, or if the design includes a pretreatment device for solids removal, use 2 as the Ksat safety factor. The WWHM has a field for entering the appropriate safety factor.	• 5,000 square feet of pollution-generating impervious surface; • 10,000 square feet of impervious surface; or • ¾ acre of lawn and landscape. If the contributing area is less than all of the above areas, or if the design includes a pretreatment device for solids removal, use 2 as the Ksat safety factor. The continuous runoff model has a field for entering the appropriate safety factor.
79.	Revisions to BMP T7.30 – Bioretention Cells, Swales, and Planter Boxes	MGS Flood no longer allowed for bioretention design	Drainage Manual Volume V	Chapter 7.3, Page 119	The void volume of the aggregate below the invert of the underdrain and above the bottom of the bioretention facility can be used in the WWHM or MGSFlood for dead storage volume that provides flow control benefit. Assume a 40% void volume for the Type 26 mineral aggregate specified below.	The void volume of the aggregate below the invert of the underdrain and above the bottom of the bioretention facility can be used for dead storage volume that provides flow control benefit. Assume a 40% void volume for the Type 26 mineral aggregate specified below.
80.	Revisions to BMP T7.30 – Bioretention Cells, Swales, and Planter Boxes	Revisions reflect modeling requirements of 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 7.3, Page 124	**Hydrologic modeling for bioretention systems** Model bioretention systems as infiltration systems using appropriate soil and hydraulic conductivity data developed as part of the Stormwater Site Plan, according to the requirements of Volume III, Chapter 3.3.10, and using the specified methods and parameters from Volume III Appendix III-C for the specific biofiltration facility type and hydrologic model used (WWHM3 or WWHM 2012). Multiple bioretention facilities with similar designs (i.e., soil depth, ponding depth, freeboard height, and drainage area to ponding area ratio), and infiltration rates (within a factor of 2) may be represented in the model as a single bioretention system with the following characteristics: • drainage area = combined drainage areas of the individual systems; • ponded area = combined ponded areas of the individual systems; • design infiltration rate = weighted average design infiltration rate, weighted by size of drainage area. For bioretention with slide slopes of 3H:1V or flatter, the applicant may model infiltration through the side slopes to the native soil.	**Runoff model representation** Note that if the project is using bioretention to only meet the BMP list approach within Minimum Requirement 5, there is no need to model the bioretention in a continuous runoff model. Size the bioretention as described above in *Ponding area*. The guidance below is to show compliance with the LID Performance Standard in Minimum Requirement 5, or the standards in Minimum Requirements 6, 7, and/or 8. Approved continuous runoff modeling software include modeling elements for bioretention. MGS Flood shall <u>not</u> be used for design of bioretention systems. The equations used by the elements are intended to simulate the wetting and drying of soil as well as how the soils function once they are saturated. This group of LID elements uses the modified Green Ampt equation to compute the surface infiltration into the amended soil. The water then moves through the top amended soil layer at the computed rate, determined by Darcy's and Van Genuchten's equations. As the soil approaches field capacity (i.e., gravity head is greater than matric head), the model determines when water will begin to infiltrate into the second soil layer (lower layer). This occurs when the matric head is less than the gravity head in the first layer (top layer). The second layer is intended to

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					In WWHM, this is done by switching the default setting for "Use Wetted Surface Area (sidewalls)" from NO to YES.	prevent loss of the amended soil layer. As the second layer approaches field capacity, the water begins to move into the third layer – the gravel underlayer. For each layer, the user inputs the depth of the layer and the type of soil. Within the WWHM continuous runoff model, for the Ecology-recommended soil specifications for each layer in the design criteria for bioretention, the model will automatically assign pre-determined appropriate values for parameters that determine water movement through that soil. These include: wilting point, minimum hydraulic conductivity, maximum saturated hydraulic conductivity, and the Van Genuchten number. For bioretention with underlying perforated drain pipes that discharge to the surface, the only volume available for storage (and modeled as storage as explained herein) is the void space within the aggregate bedding layer below the invert of the drain pipe. Use 40% void space for the Type 26 mineral aggregate described above It is preferable to enter each bioretention device and its drainage area into the approved computer models for estimating their performance. However, where site layouts involve multiple bioretention facilities, the modeling schematic can become extremely complicated or not accommodated by the available schematic grid. In those cases, multiple bioretention facilities with similar designs (i.e., soil depth, ponding depth, freeboard height, and drainage area to ponding area ratio), and infiltration rates (within a factor of 2) may have their drainage areas and ponded areas combined and represented in the runoff model as one drainage area and one bioretention device. In this case, use a weighted average of the design infiltration rates at each location. The averages are weighted by the size of their drainage areas. For bioretention with slide slopes of 3H:1V or flatter, infiltration through the side slope areas can be significant. Where side slopes are 3H:1V or flatter, bioretention can be modeled allowing infiltration through the side slope areas to the native soil. In WWHM, modeling of infiltration through the side slope areas is accomplished by switching the default setting for "Use Wetted Surface Area (sidewalls): from "NO" to "YES."

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81.	Revisions to BMP T7.30 – Bioretention Cells, Swales, and Planter Boxes	Revisions refer to new Volume VI	Drainage Manual Volume V	Chapter 7.3, page 126	Maintenance requirements for bioretention facilities are set forth in Chapter 4.6 of this volume.	See the requirements set forth in Chapter 4.6 of this volume, and in Volume VI Stormwater Facility Maintenance.
82.	Revisions to BMP T7.40 – Compost Amended Vegetated Filter Strips	Revisions refer to new Volume VI	Drainage Manual Volume V	Chapter 7.4, page 130	For maintenance of CAVFS, use the relevant maintenance requirements for bioretention systems as set forth in Chapter 4.6 of this volume.	See the requirements set forth in Chapter 4.6 of this volume, and applicable sections of bioretention system maintenance methods and standards in Volume VI Stormwater Facility Maintenance.
83.	Revisions to BMP T8.10 – Basic Sand Filter Basin	Revisions refer to defined water quality design storm	Drainage Manual Volume V	Chapter 8.5, page 138	Use a sand filter basin to capture and treat the Water Quality Design Storm volume , which is 91% of the total runoff volume as predicted by Western Washington Hydrology Model (WWHM). Only 9% of the total runoff volume should bypass or overflow from the sand filter facility.	Use a sand filter basin to capture and treat the water quality design volume as defined in Chapter 4.1.1 of this volume. Only 9% of the total runoff volume should bypass or overflow from the sand filter facility.
84.	Revisions to BMP T8.10 – Basic Sand Filter Basin	Revisions refer to modeling requirements of the 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 8.5, page 139	*Off-line design* • Off-line sand filters placed upstream of a detention facility must have a flow splitter designed to send all flows at or below the 15-minute water quality flow rate, as predicted by WWHM, to the sand filter. • Size the facility to filter all the runoff sent to it (no overflows from the treatment facility should occur). Note that WWHM allows bypass flows and filtered runoff to be directed to the downstream detention facility. • Off-line sand filters placed downstream of a detention facility must have a flow splitter designed to send all flows at or below the 2-year flow frequency from the detention pond, as predicted by WWHM, to the treatment facility. The treatment facility must be sized to filter all the runoff sent to it (no overflows from the treatment facility should occur). • For off-line filters, design the underdrain structure to pass the 2-year peak inflow rate, as determined using 15-minute time steps in an approved continuous runoff model.	*Off-line design* • Off-line sand filters placed upstream of a detention facility must have a flow splitter designed to send all flows at or below the water quality flow rate to the sand filter. • Size the facility to filter all the runoff sent to it (no overflows from the treatment facility should occur). • Off-line sand filters placed downstream of a detention facility must have a flow splitter designed to send all flows at or below the 2-year flow frequency from the detention pond, to the treatment facility. The treatment facility must be sized to filter all the runoff sent to it (no overflows from the treatment facility should occur). • For off-line filters, design the underdrain structure to pass the 2-year peak inflow rate, as determined using an approved continuous runoff hydrologic model.
85.	Revisions to BMP T8.10 – Basic Sand Filter Basin	Revisions refer to new Volume VI	Drainage Manual Volume V	Chapter 8.5, page 141	Maintenance requirements for sand filters are set forth in Chapter 4.6 of this volume.	See the requirements and standards set forth in Chapter 4.6 of this volume and in Volume VI Stormwater Facility Maintenance.
86.	Revisions to BMP T8.11 Large Sand Filter Basin	Revisions refer to modeling requirements of the 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 8.5 Page 142	The Large Sand Filter is generally subject to the same Applications and Limitations as BMP T8.10 Basic Sand Filter Basin. The difference is that the Large Sand Filter Basin uses a higher Water Quality Design Storm volume: 95% of the runoff volume of the period modeled in the WWHM model. Only 5% of the total runoff	The Large Sand Filter is generally subject to the same Applications and Limitations as BMP T8.10 Basic Sand Filter Basin. The difference is that the Large Sand Filter Basin uses a higher water quality design volume: 95% of the runoff volume of the period modeled in an approved continuous runoff hydrologic model. Only

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					volume as modeled by WWHM would bypass or overflow from the sand filter facility.	5% of the total runoff volume would bypass or overflow from the sand filter facility.
87.	Revisions to BMP T8.40 Media Filter Drain	Revisions refer to modeling requirements of the 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 8.5 , page 156	*Media Filter Drain Mix Bed Sizing Procedure* The media filter drain mix should be a minimum of 12 inches deep, including the section on top of the underdrain trench. For runoff treatment, sizing the media filter drain mix bed is based on the requirement that the runoff treatment flow rate from the pavement area, *QHighway,* cannot exceed the long-term infiltration capacity of the media filter drain, *QInfiltration*: *Highway Infiltration Q ≤ Q* For western Washington, *QHighway* is the flow rate at or below which 91% of the runoff volume for the developed TDA will be treated, based on a 15-minute time step and can be determined using and approved continuous runoff model.	*Media Filter Drain Mix Bed Sizing Procedure* The media filter drain mix should be a minimum of 12 inches deep, including the section on top of the underdrain trench. For runoff treatment, sizing the media filter drain mix bed is based on the requirement that the water quality design flow rate from the pavement area, *QHighway,* cannot exceed the long-term infiltration capacity of the media filter drain, *QInfiltration*: *Highway Infiltration Q ≤ Q Infiltration*
88.	Revisions to BMP T8.40 Media Filter Drain	Revisions refer to new Volume VI	Drainage Manual Volume V	Chapter 8.5, Page 161	*Maintenance* Maintenance will consist of routine roadside management. While herbicides must not be applied directly over the media filter drain, it may be necessary to periodically control noxious weeds with herbicides in areas around the media filter drain as part of a roadside management program. The use of pesticides may be prohibited if the media filter drain is in a critical aquifer recharge area for drinking water supplies. The designer should check with the local area water purveyor or local health department. Areas of the media filter drain that show signs of physical damage will be replaced by local maintenance staff in consultation with region hydraulics/water quality staff. Do not allow vehicles or traffic on the MFD to minimize rutting and maintenance repairs	*Maintenance* See the requirements and standards set forth in Chapter 4.6 of this volume and in Volume VI Stormwater Facility Maintenance.
89.	Revisions to BMP T9.10 Basic Biofiltration Swale	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 9.4, page 163	• Design criteria are specified in Table 5.7. A 9-minute hydraulic residence time is used at a multiple of the peak 15 minute water quality design flow rate (Q) as defined in Chapter 4 of this volume.	• Design criteria are specified in Table 5.7. A 9-minute hydraulic residence time is used at a multiple of the water quality design flow rate (Q).

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					• Check the hydraulic capacity/stability for inflows greater than design flows. Bypass high flows, or control release rates into the biofilter, if necessary. • Install level spreaders (see Volume II, BMP C206) at the head and every 50 feet in swales of ≥4 feet width. Include sediment cleanouts (weir, settling basin, or equivalent) at the head of the biofilter as needed. • Use energy dissipaters (riprap) for increased downslopes. • <u>Guidance for Bypassing Off-line Facilities:</u> • **Most biofiltration swales are currently designed to be on-line facilities. However, an off-line design is possible.** Swales designed in an off-line mode should not engage a bypass until the flow rate exceeds a value determined by multiplying Q, the off-line water quality design flow rate predicted by the WWHM, by the ratio determined in Figure 5.27. This modified design flow rate is an estimate of the design flow rate determined by using SBUH procedures. Ecology's intent is to maintain recent biofiltration sizing recommendations (9 minutes detention at the peak design flow rate estimated by SBUH for a 6-month, 24-hour storm with a Type 1A rainfall distribution) until more definitive information is collected concerning bioswale performance. The only advantage of designing a swale to be off-line is that the stability check, which may make the swale larger, is not necessary. <u>Sizing Procedure for Biofiltration Swales</u> This guide provides biofilter swale design procedures in full detail, along with examples. *Preliminary Steps (P)* **P-1** Determine the Water Quality design flow rate (Q) in 15-minute time-steps using the WWHM. Use the correct flow rate, off-line or on-line, for your design situation. **P-2** Establish the longitudinal slope of the proposed biofilter. **P-3** Select a vegetation cover suitable for the site. Refer to Tables 5.7 and 5.8 to select vegetation.	• Check the hydraulic capacity/stability for inflows greater than design flows. Bypass high flows, or control release rates into the biofilter, if necessary. • Install level spreaders (see Volume II, BMP C206) at the head and every 50 feet in swales of ≥4 feet width. Include sediment cleanouts (weir, settling basin, or equivalent) at the head of the biofilter as needed. • Use energy dissipaters (riprap) for increased downslopes. • <u>Guidance for Bypassing Off-line Facilities:</u> • Most biofiltration swales are currently designed to be on-line facilities. However, an off-line design is possible. Swales designed in an off-line mode should not engage a bypass until the flow rate exceeds a value determined by multiplying Q, the off-line water quality design flow rate as determined by an approved continuous runoff hydrologic model, by the ratio determined in Figure 5.27. This modified design flow rate is an estimate of the design flow rate determined by using SBUH procedures. Ecology's intent is to maintain recent biofiltration sizing recommendations (9 minutes detention at the peak design flow rate estimated by SBUH for a 6-month, 24-hour storm with a Type 1A rainfall distribution) until more definitive information is collected concerning bioswale performance. The only advantage of designing a swale to be off-line is that the stability check, which may make the swale larger, is not necessary. <u>Sizing Procedure for Biofiltration Swales</u> This guide provides biofilter swale design procedures in full detail, along with examples. *Preliminary Steps (P)* **P-1** Determine the Water Quality design flow rate (Q) . Use the correct flow rate, off-line or on-line, for your design situation. **P-2** Establish the longitudinal slope of the proposed biofilter. **P-3** Select a vegetation cover suitable for the site. Refer to Tables 5.7 and 5.8 to select vegetation.

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Line #	Brief Description of the Change	Rationale for the Change (attach supporting documents if necessary)	Enforceable Document Being Updated	Section Within the Enforceable Document Being Updated	Text as Written in the 2014 Functionally Equivalent Enforceable Document	Proposed Text for Ecology Review and Approval
90.	Revisions to BMP T9.10 Basic Biofiltration Swale	Revisions refer to term defined 'water quality design flow rate	Drainage Manual Volume V	Chapter 9.4, Page 171	K = A ratio of the peak volumetric flow rate using a 10-minute time step predicted by SBUH to the water quality design flow rate estimated using the WWHM. The value of K is determined from Figure 5.28 for on-line facilities, or Figure 5.29 for off-line facilities.	K = A ratio of the peak volumetric flow rate using a 10-minute time step predicted by SBUH to the water quality design flow rate. The value of K is determined from Figure 5.28 for on-line facilities, or Figure 5.29 for off-line facilities.
91.	Revisions to BMP T9.10 Basic Biofiltration Swale	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 9.4, Page 173	**SC-1**. Perform the stability check for the 100-year, return frequency flow using 15-minute time steps using an approved continuous runoff model. Until WWHM peak flow rates in 15-minute time steps are available the designer can use the WWHM 100-yr. hourly peak flows times an adjustment factor of 1.6 to approximate peak flows in 15-minute time steps.	**SC-1**. Perform the stability check for the 100-year return frequency flow derived using an approved continuous runoff hydrologic model.
92.	Revisions to BMP T9.10 Basic Biofiltration Swale	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 9.4, Page 176	**P-1**. Assume that the WWHM based Water Quality Design Flow Rate in 15 minute time-steps, Q, is 0.2 cfs. Assume an on-line facility.	**P-1**. Assume that the Water Quality Design Flow Rate, Q, is 0.2 cfs. Assume an on-line facility.
93.	Revisions to BMP T9.10 Basic Biofiltration Swale	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 9.4, Page 177	**SC-1.** Base the check on passing the 100-year, return frequency flow (15 minute time steps) through a swale with a mixture of Kentucky bluegrass and tall fescue on loose erodible soil. Until WWHM peak flow rates in 15-minute time steps are available the designer can use the WWHM 100-yr. hourly peak flows times an adjustment factor of 1.6 to approximate peak flows in 15-minute time steps. Assume that the adjusted peak Q is 1.92 cfs.	**SC-1.** Base the check on passing the 100-year return frequency flow through a swale with a mixture of Kentucky bluegrass and tall fescue on loose erodible soil. Assume that the peak Q is 1.92 cfs.
94.	Revisions to BMP T9.10 Basic Biofiltration Swale	Revisions refer to new Volume VI	Drainage Manual Volume V	Chapter 9.4, Page 182	Maintenance requirements for drainage facilities are set forth in Chapter 4.6 of this volume.	See requirements set forth in Chapter 4.6 of this volume and in Volume VI Stormwater Facility Maintenance.
95.	Revisions to BMP T9.20 Wet Biofiltration Swale	Revisions refer to new Volume VI	Drainage Manual Volume V	Chapter 9.4, Page 184	Maintenance requirements for drainage facilities are set forth in Chapter 7.53.140 SCC and Volume V, Chapter 4.6 of this manual.	See requirements set forth in Chapter 4.6 of this volume and Volume VI Stormwater Facility Maintenance.
96.	Revisions to BMP T9.40 Basic Filter Strip	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 9.4, Page 188	*Note: As in swale design an adjustment factor of K accounts for the differential between the WWHM Water Quality design flow rate and the SBUH design flow*	*Note: As in swale design an adjustment factor of K accounts for the differential between the Water Quality design flow rate and the SBUH design flow*
97.	Revisions to BMP T10.10 Wetponds - Basic and Large	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 10.3, page 190	The primary design factor that determines a wetpond's treatment efficiency is the volume of the wetpool. The larger the wetpool volume, the greater the potential for pollutant removal. For a basic wetpond, the wetpool volume provided shall be equal to or greater than the total volume of runoff from the water quality design storm - the 6-month, 24-hour storm event. Alternatively,	The primary design factor that determines a wetpond's treatment efficiency is the volume of the wetpool. The larger the wetpool volume, the greater the potential for pollutant removal. For a basic wetpond, the wetpool volume provided shall be equal to or greater than the water quality design volume. A large wetpond requires a wetpool volume at least 1.5 times larger than the water quality design volume. Also important are the

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					the 91st percentile, 24-hour runoff volume indicated by an approved continuous runoff model. A large wetpond requires a wetpool volume at least 1.5 times larger than the total volume of runoff from the 6-month, 24-hour storm event. Also important are the avoidance of short-circuiting and the promotion of plug flow. ***Plug flow*** describes the hypothetical condition of stormwater moving through the pond as a unit, displacing the "old" water in the pond with incoming flows. To prevent short-circuiting, water is forced to flow, to the extent practical, to all potentially available flow routes, avoiding "dead zones" and maximizing the time water stays in the pond during the active part of a storm.	avoidance of short-circuiting and the promotion of plug flow. ***Plug flow*** describes the hypothetical condition of stormwater moving through the pond as a unit, displacing the "old" water in the pond with incoming flows. To prevent short-circuiting, water is forced to flow, to the extent practical, to all potentially available flow routes, avoiding "dead zones" and maximizing the time water stays in the pond during the active part of a storm.
98.	Revisions to BMP T10.10 Wetponds - Basic and Large	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 10.3, page 191	*Step 1:* Identify required wetpool volume using the SCS (now known as NRCS) curve number equations presented in Volume III, Chapter 2. A basic wetpond requires a volume equal to or greater than the total volume of runoff from the 6-month, 24-hour storm event. Alternatively, use the 91st percentile, 24-hour runoff volume indicated by an approved continuous runoff model. A large wetpond requires a volume at least 1.5 times the total volume of runoff from the 6-month, 24-hour storm event, or 1.5 times the 91st percentile, 24-hour runoff volume indicated by an approved continuous runoff model.	*Step 1:* Identify required wetpool volume . A basic wetpond requires a volume equal to or greater than the water quality design volume. A large wetpond requires a volume at least 1.5 times the water quality design volume.
99.	Revisions to BMP T10.10 Wetponds - Basic and Large	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 10.3, page 191	a) Use the nomographs in Figures 5.32 and 5.33 to select a trial size for the pond outlet pipe sufficient to pass the on-line WQ design flow, Q_{wq} indicated by WWHM or other approved continuous runoff model.	1. Use the nomographs in Figures 5.32 and 5.33 to select a trial size for the pond outlet pipe sufficient to pass the on-line WQ design flow, Q_{wq} indicated by an approved continuous runoff hydrologic model.
100.	Revisions to BMP T10.10 Wetponds - Basic and Large	Revisions refer to new volume VI	Drainage Manual Volume V	Chapter 10.3, page 195	Maintenance requirements for drainage facilities are set forth in Chapter 4.6 of this volume.	See requirements set forth in Chapter 4.6 of this volume and Volume VI Stormwater Facility Maintenance.
101.	Revisions to BMP T10.20 Wetvaults	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 10.3, page 201	The sizing procedure for a wetvault is identical to the sizing procedure for a wetpond. The wetpool volume for the wetvault shall be equal to or greater than the total volume of runoff from the 6-month, 24-hour storm event. Alternatively, the 91st percentile, 24-hour runoff volume estimated by an approved continuous runoff model may be used.	The sizing procedure for a wetvault is identical to the sizing procedure for a wetpond. The wetpool volume for the wetvault shall be equal to or greater than the water quality design volume.
102.	Revisions to BMP T10.20 Wetvaults	Revisions refer to new volume VI	Drainage Manual Volume V	Chapter 10.3, page 203	Maintenance requirements for drainage facilities are set forth in Chapter 7.53.140 SCC and Volume V, Chapter 4.6 of this manual.	See requirements and standards set forth in Chapter 4.6 of this volume, and Volume VI Stormwater Facility Maintenance.

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103.	Revisions to BMP T10.30 Stormwater Treatment Wetlands	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 10.3, page 204	*Step 1:* The volume of a basic wetpond is used as a template for sizing the stormwater wetland. The design volume is the total volume of runoff from the 6-month, 24-hour storm event. Alternatively, the 91st percentile, 24-hour runoff volume estimated by an approved continuous runoff model may be used.	*Step 1:* The volume of a basic wetpond is used as a template for sizing the stormwater wetland. The design volume is the water quality design volume.
104.	Revisions to BMP T10.30 Stormwater Treatment Wetlands	Revisions refer to new volume VI	Drainage Manual Volume V	Chapter 10.3, page 209	Maintenance requirements for wetponds shall apply to stormwater treatment wetlands. Maintenance requirements for drainage facilities are set forth in Chapter 4.6 of this volume.	Maintenance requirements for wetponds shall apply to stormwater treatment wetlands. See requirements and standards set forth in Chapter 4.6 of this volume and in Volume VI Stormwater Facility Maintenance.
105.	Revisions to BMP T10.40 Combined Detention and Wetpool Facilities	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 10.3, page 210	The sizing procedure for combined detention and wetponds are identical to those outlined for wetponds and for detention facilities. The wetpool volume for a combined facility shall be equal to or greater than the total volume of runoff from the 6-month, 24-hour storm event. Alternatively, the 91st percentile, 24-hour runoff volume estimated by an approved continuous runoff model may be used to size the wetpool. Follow the standard procedure specified in Volume III to size the detention portion of the pond.	The sizing procedure for combined detention and wetponds are identical to those outlined for wetponds and for detention facilities. The wetpool volume for a combined facility shall be equal to or greater than the water quality design volume. Follow the standard procedure specified in Volume III to size the detention portion of the pond.
106.	Revisions to BMP T10.40 Combined Detention and Wetpool Facilities	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 10.3, page 215	The sizing procedure for combined detention and wetvaults is identical to those outlined for wetvaults and for detention facilities. The wetvault volume for a combined facility shall be equal to or greater than the total volume of runoff from the 6-month, 24-hour storm event. Alternatively, the 91st percentile, 24-hour runoff volume estimated by an approved continuous runoff model may be used to size the wetpool portion of vault. Follow the standard procedure specified in Volume III to size the detention portion of the vault.	The sizing procedure for combined detention and wetvaults is identical to those outlined for wetvaults and for detention facilities. The wetvault volume for a combined facility shall be equal to or greater than the water quality design volume. Follow the standard procedure specified in Volume III to size the detention portion of the vault.
107.	Revisions to BMP T10.40 Combined Detention and Wetpool Facilities	Added maintenance requirement reference	Drainage Manual Volume V	Chapter 10.3, page 216	[no text]	Maintenance requirements for wetponds and detention ponds shall apply to combined detention and wetpool facilities. See requirements and standards set forth in Chapter 4.6 of this volume and in Volume VI Stormwater Facility Maintenance
108.	Revisions to BMP T11.10 API (Baffle type) Separator Bay	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 11.7, page 222	Q = (k) the ratio indicated in Figure 5.28 (on-line) or Figure 5.29 (off-line) for the site location multiplied by the 15-minute Water Quality design flow rate in ft^3/min, at minimum residence time, t_m	Q = (k) the ratio indicated in Figure 5.28 (on-line) or Figure 5.29 (off-line) for the site location multiplied by the water quality design flow rate in ft^3/min, at minimum residence time, t_m

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109.	Revisions to BMP T11.10 API (Baffle type) Separator Bay	Revisions refer to new Volume VI	Drainage Manual Volume V	Chapter 11.7, page 222	Maintenance requirements for drainage facilities are set forth in Chapter 4.6 of this volume.	See requirements and standards set forth in Chapter 4.6 of this volume, and in Volume VI Stormwater Facility Maintenance.
110.	Revisions to BMP T11.11 Coalescing Plate (CP) Separator Bay	Revisions refer to updated modeling requirements in 2019 Ecology SWMMWW	Drainage Manual Volume V	Chapter 11.7, page 224	• Q = (k) the ratio indicated in Figure 5.26 (on-line) or Figure 5.27 (off-line) for the site location multiplied by the 15-minute Water Quality design flow rate in ft^3/min, at minimum residence time, t_m	Q = (k) the ratio indicated in Figure 5.26 (on-line) or Figure 5.27 (off-line) for the site location multiplied by the water quality design flow rate in ft^3/min, at minimum residence time, t_m
111.	Revisions to BMP T11.11 Coalescing Plate (CP) Separator Bay	Revisions refer to new Volume VI	Drainage Manual Volume V	Chapter 11.7, page 224	Maintenance requirements for drainage facilities are set forth in Chapter 4.6 of this volume.	See requirements and standards set forth in Chapter 4.6 of this volume, and in Volume VI Stormwater Facility Maintenance.
112.	New Volume VI – Stormwater Facility Maintenance added to Drainage Manual	New volume contains existing maintenance standards moved from Volume V Chapter 4.6, plus additional guidance helpful to private owners of stormwater facilities	Drainage Manual Volume VI	[entire Volume VI]	[no text]	[entire Volume VI]
113.	New maintenance standard for BMP T5.17 Vegetated Roofs	Maintenance standard added to meet requirements of MS4 Permit Special Condition S5.C.10.a	Drainage Manual Volume VI 9new volume)	21. – Vegetated Roofs, page 107	[no text]	[see text starting on page 107 of new Volume VI]